# Restoring a Desert Oasis

by Jody Fraser and
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***Restoring natural vegetation along Ash Meadows creek.***
*Photo by D. Ledig/USFWS*

***Kings Pool, before (above) and after restoration***
*USFWS photos*

Just east of Death Valley, where a mere 3 inches (7.5 centimeters) of rain falls annually, lies the oasis of Ash Meadows, Nevada, an unusual system of wetlands, springs, and seeps. Plentiful sources of water in this part of the vast Mojave Desert are rare, and Ash Meadows has drawn humans since prehistoric times. A rich variety of aquatic and terrestrial species also depend on this fragile, isolated ecosystem.

The perennial surface waters of the region are supplied by an extensive ground water system that discharges about 17,000 acre-feet (2,100 hectare-meters) each year in Ash Meadows. This distinct desert ecosystem supports hundreds of plant and animal species that are closely associated with, and often dependent upon, the area's unique wetland and aquatic habitats. Among these species, 24 are found only in Ash Meadows, constituting the largest concentration of endemism for an area this size in the continental United States. Twelve species are currently listed under the Endangered Species Act.

Around 1850, a wave of settlers moved into the region, initiating dramatic changes in the Ash Meadows area. Several boom and bust cycles ensued over the course of decades, with mining and agriculture being the focus of the early homesteaders. They altered the landscape and water courses with a series of impoundments, ditches, and diversions. Various nonnative fishes, amphibians, plants, and invertebrates were introduced. The construction of a railroad inspired the establishment of freight and mercantile businesses, and farmers grew fields of hay for horses and other pack animals. Clay mining operations were active from about 1916 to 1940, and the nuclear testing program at the nearby Nevada Test Site provided a source for jobs in the 1950s, increasing the demand for water.

In Ash Meadows, the springs system comprises seven major springs and over 20 smaller ones. The pools and outflows in the Kings Spring and Point of Rocks Springs areas, in particular, were heavily manipulated in the 1950s for aesthetic and agricultural purposes. Farmers diverted water from Kings Spring into a concrete ditch and removed riparian vegetation to grow crops. The Ash Meadows naucorid *(Ambrysus amargosus)*, an aquatic insect, and the Ash Meadows speckled dace *(Rhinichthys osculus nevadensis)*, a small fish, were extirpated from the Kings Spring system shortly after people modified the landscape and water courses. In the 1960s, large-scale agriculture and peat mining at Carson Slough in the northern part of Ash Meadows caused the most significant changes to the landscape, destroying extensive wetlands and degrading valuable habitat for endemic species.

The loss of habitats and species diversity would have continued unchecked but for the concern of conservationists over the plight of the Devils Hole pupfish *(Cyprinodon diabolis)*. In the early 1970s, intensive water use associated with development in the Ash Meadows area degraded wetland habitats and lowered the water table in Devils Hole, the endangered species' only habitat. It became clear that the fate of this tiny fish was at stake. In 1976 the U.S. Supreme Court limited the amount of ground water pumping in Ash Meadows to ensure enough water for the Devils Hole pupfish, if not for the area's

other vulnerable species. (See accompanying article.)

Lands in Ash Meadows were later sold to a development company and targeted for municipal and residential use. Development had already begun to degrade important habitats when, in 1984, the company decided to abandon its project and sold most of its holdings and water rights to The Nature Conservancy. Subsequently, the U.S. Fish and Wildlife Service purchased the land and the water rights to establish the Ash Meadows National Wildlife Refuge.

The Recovery Plan for the Endangered and Threatened Species of Ash Meadows was developed in 1990. Its primary objective is to recover the listed species and their habitats through an ecosystem approach focusing on habitat restoration and the removal of threats. Listed species addressed in the recovery plan include an endangered plant, the Amargosa niterwort *(Nitrophila mohavensis)*; six threatened plants, the spring-loving centaury *(Centaurium namophilum)*, Ash Meadows ivesia *(Ivesia eremica)*, Ash Meadows blazing star *(Mentzelia leucophylla)*, Ash Meadows milkvetch *(Astragalus phoenix)*, Ash Meadows sunray *(Enceliopsis nudicaulis* var. *corrugata)*, and Ash Meadows gumplant *(Grindelia fraxino-pratensis)*; a threatened invertebrate, the Ash Meadows naucorid; and four endangered fishes, the Devils Hole pupfish, Warm Springs pupfish *(Cyprinodon nevadensis pectoralis)*, Ash Meadows Amargosa pupfish *(C. n. mionectes)*, and Ash Meadows speckled dace.

The most important action for the long-term protection of the listed species was the initial purchase of land and water rights to establish the refuge. It ended activities detrimental to the species and their habitats, such as residential and agricultural development, surface mining, and grazing by wild horses. Restoration of historic stream flows was also identified as a key element in the recovery of the spring system and its aquatic species.

***Ash Meadows blazing star***
*Photo by John & Karen Hollingsworth/USFWS*

After agriculture fields were abandoned, an infestation by cattails *(Typha domingensis)* prevented the regeneration of other riparian species, and the aquatic habitat remained fragmented. A comprehensive program of spring restoration on the refuge is underway, including filling of small artificial ponds, removing water diversion features, and rehabilitating the sites to reflect the natural slope and stream flow. Restored channels include such key habitat features as riffles, gravel substrate, and appropriate more natural water velocities.

In 1997, the first significant habitat restoration project in Ash Meadows was undertaken in the Kings Spring drainage, an area severely affected by decades of agricultural activities. The project was designed to mimic historic conditions by returning the spring outflow and drainage channel to a meandering stream, returning Kings Pool to its original dimensions, replacing cattails with species more appropriate for inhabitants of the aquatic and terrestrial habitats, and reconnecting ephemeral washes to the outflow channel. Restoring the entire watershed was essential to improving the status of the listed fishes and the naucorid in this spring system.

The summer following restoration, 22 naucorids were reintroduced into the outflow of Kings Spring, and an additional 17 were introduced the next year. This restoration and reintroduction effort has been a great success. Prior to the project, naucorid populations were limited to the upper 50 feet (15 meters) of the Point of Rocks Springs system. Since the reintroduction into Kings Spring, the population has grown to thousands of individuals occupying about 850 feet (260 m) of stream habitat. Similarly, the Ash Meadows Amargosa pupfish population in this system has more than tripled.

While much of the Ash Meadows ecosystem is returning to a balance reminiscent of its past, the job is not done. A challenge facing resource managers throughout the country is the invasion of natural landscapes by nonnative species, and Ash Meadows is no exception. Efforts to control nonnative species will be carried out well into the future as we work to bring back Ash Meadows. The continued cooperation of state and other federal agencies, as well as a concerned public, will enable Ash Meadows to remain a rich source of unique biodiversity for generations to come.

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***Ash Meadows naucorid***
*Photo by John & Karen Hollingsworth/USFWS*